

nately that when the electric current does not cause charring of nerve structures the paralysis or block is recovered from and the reflexes return, provided efficient artificial respiration is applied.

"7. It is of the greatest importance that artificial respiration be applied early and be maintained for a sufficient length of time. Owing to the nature of the block in the nerve centers the ordinary tests for death should not be accepted and 'nothing less than cooling of the body or the onset of rigor mortis should be considered to be evidence of death.'"

In regard to time during which artificial respiration should be carried out, Tousey in the *International Journal of Medicine and Surgery* states that three hours should be a minimum. He calls attention to the fact that even where apparently instantaneous death has occurred, resuscitation methods may succeed if persevered in for a sufficient length of time. He further states that a 110-volt current may be fatal if the person is grounded, and that voltages higher than this are dangerous under all circumstances.

A special interest attaches to this hazard because it is a preventable one, and seldom can the fatality or injury be classified as due to an "act of God." The carelessness of workers, the absence of safety devices in connection with machinery and the distribution of power are responsible for the vast majority of casualties.

CASE REPORT

The case which is here reported is that of a young man of twenty-four, in good physical condition, height 6 feet and 2 inches. He was employed in wiring the switchboard in a smelter connected with the United Verde Copper Company. Through some mischance a current was short-circuited from one hand to the other while he was changing the leads from a current transformer. He stated that the current was of low amperage, though varying somewhat from time to time. The voltage was not a fixed quantity, but started very low, and gradually increased after the circuit was closed, a maximum of 1000 or 1500 volts being possible.

The patient's description of his sensations and his psychological reactions was of great interest to the examining physician. The first sensation noticed was of a terrible crushing pressure, not translated into pain, as the word is ordinarily used. This affected the entire musculature, but was most marked in the arms and shoulders—the current passing through the hands and across the body. No sensation of heat or burning such as is frequently mentioned by the subject of electric shock was noticed.

Simultaneously with the sense of crushing pressure occurred a tremendous stimulation, both mental and physical, beyond anything in the patient's experience, and accompanied by a great surge of elation and a vast sense of power.

The next item noted was disturbance of vision, with various colors whirling more and more rapidly before the sight. From the description given these sensations and images were similar to those occurring in the early stages of chloroform anesthesia. Progressive loss of vision accompanied these sensations, ending in complete blindness while consciousness was still present and unimpaired.

Loss of ability to hear outside noises was accompanied by a sensation of hearing a loud humming or whirring noise. This noise the patient said was already associated in his mind with a current of the same frequency as the one passing through his body, under circumstances rendering it audible, and the question whether it was subjective or objective arose

in his mind. Complete unconsciousness gradually supervened.

The time that elapsed before the man was released from the contact by a fellow workman who happened to approach is not known. The patient on regaining consciousness was entirely clear mentally and was able to swear vigorously at a worker who was nearby when the accident occurred and who had stood incapable of action and rooted to the spot, with his mouth open and with a horror-stricken countenance.

The patient, during the stage of seconds or minutes—he had no knowledge of the passing of time—was sure that death was at hand, but felt no fear whatever. He was conscious only of a mighty rage directed at the paralyzed man who stood in the line of his vision without making a movement to rescue him. The patient, of course, could not speak nor express his inward rage as he gazed.

The first after-effects noticed were extreme pain over the brachial plexus on each side, radiating over the area supplied by the plexus. This burning pain prevented sleep entirely for several nights, and continued uninterrupted, but with gradual diminution, for three weeks or more. About four days after the injury, blisters appeared, and a herpetic eruption followed, covering an area of not less than 100 square inches, on either side of the thorax, and almost meeting in front. This was not quite symmetrical, the upper margin on one side being somewhat higher than the other. The pain, however, seemed to the patient to cover exactly the same area on each side. This herpetic eruption lasted about three weeks, and gradually faded away, as in herpes from any cause.

There was no pain on breathing or coughing. The pain caused by using the arms was severe, but not unbearable, and the man resumed his work the next day, but spent several nights walking the floor, unable to sleep on account of pain.

The muscles of the arms and chest were exceedingly sore to the touch for some three or four weeks, but gradually became entirely normal.

The only local effect on the hands, which were not painful, was that a small core of entirely carbonized flesh sloughed out of a cylindrical matrix on one finger of each hand, the right hand preceding the left by a few days. The skin was not discolored on the hands or arms, nor elsewhere except as normally follows a herpetic eruption.

There was no permanent impairment of function in any way nor did the general health appear to suffer. No residuum exists, after a period of several years, except that the patient feels a wave of anger still when he thinks of the vacant countenance of his fellow worker, which he thought was the last sight his eyes would behold on this earth.

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MANAGEMENT OF HEART CONDITIONS IN CHILDREN*

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BETWEEN eight and nine thousand children in Los Angeles public schools suffer from heart trouble in some form. These cases had been handled in a rather haphazard manner with nothing accomplished from a constructive standpoint. In the spring of 1925 the Director of Health and Physical Education of the Los Angeles public schools called together a few men interested in heart conditions in children, to formulate a plan to give these children with heart disease

* A review of the work done by the Consulting Heart Board of the Los Angeles public schools.

* Chairman's address, Pediatrics Section, California Medical Association, at its Fifty-seventh Annual Session, April 30 to May 3, 1928.

in the public schools the opportunity of getting physical education as well as mental training. As a result of this conference a board of five members was formed, which started functioning in 1925. The children were referred by the school physicians or the school nurses for diagnosis and recommendations. The board is now in its third year and accomplishing some important things, which may be worth reporting. The personnel of the board has been increased to nine members, meets once a week and examines from twelve to fifteen children each time.

The children examined are from families who have no family physician, or whose financial status does not permit the services of a private physician or who wish diagnosis from the heart board. If difference of opinion arises between the school physician and the family physician the board acts as arbiter. The board invites consultation with the man in family practice; the members serve without compensation and are endorsed by the Los Angeles County Medical Association.

The children we see are from five to eighteen years of age, because no child is examined who is not in school. The years of athletics, particularly of the athletic competitive type, are the years when real or suspected cardiac cases are discovered.

TYPES OF CASES

Types of cases referred to the board comprise four general groups: (1) normal hearts with functional disturbances, (2) congenital heart disease, (3) potential cardiac disease, (4) definite cardiac disease.

Under functional disturbance are classified:

1. (a) The slight arrhythmia seen so frequently in the growing child; (b) the tachycardia of the child with an unstable nervous mechanism which is caused at the time of puberty or even before, by the slightest exertion or nervous excitement; (c) the faint hemic murmur that is heard at some point over the heart but that changes or disappears entirely upon changing position; (d) the murmur brought on by overfatigue from excessive school work, or late hours, or by an excessive use of tea or coffee.

2. The child with the congenital heart may have a basal murmur with a thrill and no other signs or symptoms, or have cyanotic clubbed extremities with more or less of a basal murmur.

3. The potential cardiac patient, and by this is meant the child with a history of frequent attacks of rheumatism, tonsillitis or chorea, who has a slight cardiac hypertrophy and possibly a faint murmur at the apex which is transmitted toward the axilla, but whose x-ray and electrocardiograph show no marked changes in the size of the heart or the muscle conductivity.

4. The true cardiac patient is interesting by reason of the variety of the lesions met, from the faint mitral systolic blow with a definite increase in the size of the left ventricle, to the heart with involvement of most of its valves, marked hyper-

trophy and even in some cases dilatation with edema of the extremities.

We find a number of children around the ages of 12 and 15 who show signs of definite mitral stenosis. The clinical signs may be slight in earlier years, but as the child is watched through the months the symptoms become more definite. We have seen six or seven boys with true aortic regurgitation, increased left ventricular dullness and the diastolic note over the sternum around the third rib, the Corrigan pulse with pistol shot sound heard in the groin and a palpable pulse in the ankle.

One boy had a definite aortic stenosis with the anacrotic pulse and a systolic blow over the aortic area and left ventricular hypertrophy. We have had one case of dextrocardia with chronic endocarditis superimposed. We see many children with mitral insufficiency in various stages of compensation, many well compensated.

Each child is examined by two or more members of the board. Every child, who has not a normal heart, has an electrocardiograph tracing made and an orthodiagram made. He is returned in one week from the first examination for a second examination and a study of the laboratory reports. Cases that warrant a blood count, urinalysis and blood pressure study, have on this second visit all of the findings correlated and a final diagnosis recorded. Instructions are given to the child, to his parents and to the principal of the school he attends. A copy of the findings is sent to the school physician.

PROGNOSIS

The outcome for these heart cases depends upon the type, causes, age when discovered and sex.

The child with the congenital heart, associated with clubbed fingers and cyanosis of variable degree, needs watching and protection from heart strain. The child with a congenital heart lesion, found to be symptomless otherwise may lead a natural life and indulge in normal physical activities. For reasons of safety, competitive athletics are debarred.

The type of lesion and condition of the heart muscle determine the prognosis of acquired lesions. The future happiness of the child depends upon early discovery and proper care of the heart lesion. As the child grows older, providing no new infection sets in, the heart will gradually outgrow some of the defects, in fact may even completely obliterate the clinical signs. At puberty the strain sometimes tells severely, especially on girls. The girl may pass this period with no trouble at all and develop into a normal young woman. The question of future marriage and pregnancy will depend largely upon the care given during the earlier years of heart trouble. Building up a strong body and heart with avoidance of further infections will prepare these girls for their future duties as citizens.

The boys will usually make their way in life through their mental rather than their physical powers. Whatever they do physically must be

within their strength and their strength will be the capacity of their heart muscle.

TREATMENT

Rest.—For any tired or overworked muscle rest is essential. The heart is no exception. Rest may mean only restriction of physical activities, a sitting period after a certain amount of exercise, or lying prone in bed for a definite period. Heart fatigue shows itself by breathlessness upon exertion with rapid pulse rate which is slow to return to normal; pallor or cyanosis; sweating upon exertion out of proportion to the amount of effort expended and by decompensation with edema. Rest has accomplished the desired effect when, after a definite period, the heart shows an ability to function with apparent ease.

Diet.—The diet is important. It must be nutritious, contain vitamins and allow for growth. It must be palatable, as many of these children have poor appetites, especially if there is any decompensation. It must have sufficient roughage and yet avoid excessive gas production.

Waste material is cared for by daily baths, proper diet and plenty of water.

Exercise.—Activities may be graded according to the case. For the bedridden child we use passive motions and massage. These stimulate the skin and muscles, improve circulation in other parts and aid in elimination of waste products. For the less severe case, walks on level floors or the ground are prescribed. As soon as the child feels fatigue he should stop at once. The child who has only slight damage of the heart may climb stairs, the number of flights and the rate of ascent depending upon the cardiac reaction.

For many cases we advise corrective gymnastics under supervision, as calisthenics, setting-up exercises and finally regular gymnasium work.

We do not recommend any competitive athletics for children with any form of heart disease. Some of our colleagues permit these competitive games but they are doing so with the child under their direct supervision. We, as a heart board, are accountable to the Board of Education, and as a board cannot assume such responsibility, no matter what our individual opinions may be. It is true that as a muscle is exercised so it will develop. The same applies to the cardiac muscle provided no infection is present. All infected foci, infected tonsils, adenoids, sinuses, and carious teeth should be removed as potential sources of reinfection of the heart.

Exercise must be gradual and be increased as the heart muscle strengthens. The stronger the muscle, the more work it can do. The loudness of the murmur does not denote the severity of the lesion. The size of the heart does not denote its strength.

Functional hearts, so-called, are treated by proper rest periods, nutritious foods, and if exercise is indicated such is given under supervision. At times when the nervous system is unstable, as at the time of puberty, where the glands of internal secretion have not completely coordinated, the heart may show signs of irritation, as in the tachycardia of the adolescent thyroid.

Such irritability will gradually correct itself under proper care. These cases are not true cardiac cases.

When there is high blood pressure, and this may occur even in children as young as 14 years, the cause must be determined. Meantime, physical activities should be curtailed. A lessening of activity may prolong life.

Valve disease, as aortic and the early mitral stenosis will have less cardiac embarrassment with lessened physical activity.

Every case must be graded and directed individually. There are only a few blanket rules or directions, as noted above. Youth has wonderful reparative powers. Nature unaided will do her best to heal; aided, she frequently effects a cure.

The cardiac patient must not be alarmed but must be warned that caution is necessary. Every effort must be made to avoid making invalids out of normal children merely because a faint functional murmur is heard over the heart area, during adolescence. These children have no cardiac pathology and we must assure them that no pathology exists.

Much needless mental distress may be avoided by care in diagnosis; much physical suffering avoided by care in treatment. Cheerfulness on the part of attendants, in the surroundings, good hygiene, good food and something to occupy the mind, are all most useful aids.

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THE PROTEIN TEST FOR UREA-FORMATION FUNCTION OF THE LIVER*

A REPORT OF THE COMPARATIVE VALUE IN HEALTH
AND DISEASE

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PROGRESS in the diagnosis and treatment of hepatic disease necessarily depends upon not only an accurate knowledge of the anatomy and physiology of the liver in health and disease, but also upon a knowledge of the reserve functional capacity of the organ. As details of the mechanism controlling normal physiological activity come to light, attention becomes more directly focused on the changes produced in disease.

DETERMINATIONS THROUGH RECENT LABORATORY METHODS

In more recent years laboratory methods by which these early hepatic changes may be estimated have been attempted with some disappointment. This, however, is not without explanation, inasmuch as the liver is concerned in intermediary metabolism and like the kidney, has great reserve potentialities. The problem is still further complicated by the fact that when the liver is removed experimentally Fiske and Sumner¹

* From the Medical Service, Letterman General Hospital, San Francisco. By E. H. Theis, M. D., First Lieutenant, Medical Corps, United States Army. Published with permission of the Surgeon-General, United States Army, who is not responsible for any opinion expressed or conclusions reached herein.

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